Consumer and Corporate Affairs Canada | Consommation et Corporations Canada

(11) (A) No. 1 222 448

(45) ISSUED 870602

(52) CLASS 166-68

(51) INT. CL.[4] E21B 17/00

(19) (CA) **CANADIAN PATENT** (12)

(54) Casing Shoe

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(21) APPLICATION No. 404,246

(22) FILED 820601

No. OF CLAIMS 13

Canada

DISTRIBUTED BY THE PATENT OFFICE, OTTAWA.
CCA-274 (11-82)

404246

ABSTRACT

A cylindrical casing shoe adapted for use on well casing or drill string. Carbide buttons in cylindrical form are press-fitted into complementary recesses on the bottom of the casing shoe.

INTRODUCTION

This invention relates to an improved casing shoe for use on well casing or drill string.

BACKGROUND OF THE INVENTION

Well casing is used to keep the drill hole free from debris and, additionally, to prevent contamination of ground water which may be present in an area which is passed through by the drill bit and is not of interest. Well casing follows the drill bit downwardly and it may be installed by impact or torsional twisting. When casing is used which has no hardened tip, it tends to collapse inwardly or "orange peel" as it passes through the formation. To change the drill bit, the drill must be withdrawn through the casing. If the casing has collapsed, it is not possible to withdraw the bit without also withdrawing the casing. This is costly and time consuming.

A further problem is presented with untreated well casing in hard rock formations. Casing may not penetrate hard rock formations without "under reaming." That is, the drill must drill a hole larger than the casing diameter to allow easier casing penetration. This is obviously inefficient if it can be avoided.

Some improvement in the longevity of well casing was achieved by installing casing utilizing a hard facing. This took various forms but one technique was to utilize a pulverized carbide mix and bonding the mix to the bottom of the casing by using a brass bonding agent. This improved the ability of the casing to penetrate the formation being drilled but the carbide layer could wear out quickly because it tended to peel off in a layer and, of course, only a single layer could be bonded on the bottom of the casing. Once the layer was removed, the problems previously described reappeared as with untreated casing.

BRIEF SUMMARY OF THE INVENTION

According to one aspect of the invention, there is disclosed a cylindrical casing shoe adapted for connection to well casing or drill string, said shoe having a first surface adapted to connect to said well casing or drill string, a second surface opposed to said first surface, an inside diameter, an outside diameter and a plurality of metallic protuberances having cylindrical bases extending outwardly from said second surface, said bases being mounted in complementary recesses extending inwardly from said second surface between

said inside and outside diameters.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

An embodiment of the invention will now be described, by way of example only, with reference to the following drawings in which:

Figure 1 is an exploded view of the casing and the casing shoe of the present invention;

Figure 2 is a view of the casing shoe in cutaway showing the shoe installed to the casing; and

Figure 3 is a view taken along the section III-III of Figure 2.

DETAILED DESCRIPTION

Referring now to Figure 1, well casing 10 is cylindrical in form and extends downwardly to the casing shoe shown generally at 11.

Casing shoe 11 is cylindrical with an outside diameter O.D. and an inside diameter I.D. It is manufactured by using steel tubing or steel plate which is cut into proper size. Following cutting, the steel is milled and is made in various sizes to fit the well casing with which it is to be used. Depending on the drilling conditions, the steel may or may not be additionally hardened.

The casing shoe 11 is counter sunk at 12 to allow the casing shoe 11 to be mounted on the well casing 10 by welding at weld 13.

The lower surface of the casing shoe 11 is divided into two areas 14,15. The first portion 14 of the lower surface is substantially normal to the centre line 16 of the casing 10 and shoe 11. The second portion 15 is bevelled and it extends from the junction of the first portion 14, upwardly and outwardly to the outside diameter O.D. of the casing shoe 11.

Carbide buttons 17 are manufactured and have rounded tips and cylindrical bases. Complementary cylindrical recesses 18 are drilled in the casing shoe 11.

As seen in Figures 2 and 3, the carbide buttons 17 are mounted both in the first and second portions 14,15

respectively, of the lower surface. The recesses 18 for the second portion 15 of the lower surface are drilled such that they extend normal to the surface. This is also so in respect of the recesses drilled in the first portion 14 of the lower surface but, as seen in Figure 3, the recesses 18 which are shown mainly being within the first surface portion 14 also extend over to the second portion 15. This creates no undue problems and facilitates manufacture.

The carbide buttons 17 mounted within the second portion 15 are pressed into recesses 18 such that their rounded tips extend slightly beyond the outside diameter of the casing shoe 11. They may also be installed using an epoxy adhesive.

OPERATION

In operation, the correct size casing shoe 11 will be selected for the particular casing with which it is decided to use for the well being drilled. The shoe 11 is mounted on the well casing 10 by fitting the shoe 11 over the end of the first piece of well casing and welding the shoe 11 to the casing 10 as at weld 13.

Thereafter, drilling and the insertion of subsequent pieces of well casing continues until the operating depth of the well

is reached whereupon the shoe is simply left in place at the bottom of the well on the casing.

Many modifications can be made to the specific embodiment of the invention just described. The casing shoe could also be attached to the well casing at other locations than on the bottom. For example, a casing shoe could be attached on the outside of the well casing with the carbide buttons facing upwardly. This would be useful if it was desired to remove the well casing when necessary such as if the well was a dry hole. The shoe would be installed by simply welding the first surface to the outside of the casing.

To like effect, the shoe could be used directly on drill string for drilling in some formations. Thus, a first shoe could be installed on the lowermost piece of drill string and, if desired, a second shoe could be installed upwardly therefrom with the carbide buttons facing upwardly so as to aid when removing the drill string from the hole.

Yet a further modification could be made in the placement of the carbide buttons. A second bevelled edge could be formed on the inside of the casing shoe. Thus, one set of carbide buttons would face inwardly. This would be useful when the shoe was used for drilling or when enlarging the hole diameter.

The carbide buttons 17 may be ground or they may be utility grade. Since the tolerances can be maintained more accurately with ground buttons, they are preferable for heavy duty application or in an application where it is desirable to minimize replacing a casing shoe during drilling operations.

It is also possible to case harden the steel of the casing shoe 11. This case hardening may be desirable for particularly hard formations or where drilling conditions subsequently dictate the use of a harder casing shoe.

The carbide buttons 17 may be additionally reinforced when being pressed into recesses 18. They can be inserted with an epoxy solution which helps to keep the buttons within their complementary recesses. One such epoxy solution is known as LOC-TITE (TRADE MARK).

The outside diameter O.D. of the casing shoe may also be bevelled inwardly from the lower surface to the upper surface. This taper allows the casing shoe to be withdrawn from the well hole more easily.

Accordingly, there has been described a casing shoe for use on drill string or well casing. Many modifications can be made additional to those described above which will still fall within the scope of the invention. The invention should, therefore, be construed by the scope of the accompanying claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A cylindrical casing shoe adapted for connection to well casing or drill string, said shoe having a first surface adapted to connect to said well casing or drill string, a second surface opposed to said first surface, an inside diameter, an outside diameter and a plurality of metallic protuberances having cylindrical bases extending outwardly from said second surface, said bases being mounted in complementary recesses extending inwardly from said second surface between said inside and outside diameters.

2. A casing shoe as in claim 1 wherein said second surface comprises a first and second area, said first area being substantially perpendicular to the axis of said cylinder and extending outwardly from said inside diameter, said second area being bevelled and extending outwardly and away from said first area to said outside diameter.

3. A casing shoe as in claim 2 wherein said recesses and said metallic protuberances extending from said second area have axes which extend substantially perpendicular to the surface of said second area.

4. A casing shoe as in claim 3 wherein the tips of said metallic protuberances mounted in said second area extend

outwardly of the outside diameter of said casing shoe.

5. A casing shoe as in claim 4 wherein the outer cylindrical surface of said casing shoe is bevelled slightly inwardly from said second area of said outside diameter to said upper surface.

6. A casing shoe as in claim 5 wherein said first surface is countersunk to allow connection of said casing shoe to said well casing or drill string.

7. A casing shoe as in claim 5 wherein the ends of said metallic protuberances are rounded.

8. A cylindrical casing shoe adapted for use on well casing or drill string, said shoe having a second surface divided into a first portion being substantially normal to the axis of said cylinder and extending outwardly from the inside diameter of said casing shoe and a second portion extending outwardly away from said first portion to the outside diameter of said casing shoe, a plurality of metallic protuberances extending outwardly from said second surface and having cylindrical bases adapted to fit within complementary cylindrical recesses in said second surface, each of said cylindrical bases extending from said second

surface inwardly at an angle substantially normal to each of said respective first and second portions.

9. A casing shoe as in claim 8 wherein the outer surface of said casing shoe is angled inwardly from said outer diameter adjacent said second surface to the first surface of said casing shoe.

10. A casing shoe as in claim 7 wherein said metallic protuberances are carbide material.

11. A casing shoe as in claim 9 wherein said metallic protuberances are carbide material.

12. A casing shoe as in claim 1 wherein said cylindrical bases fit said complementary recesses in a press fit.

13. A casing shoe as in claim 9 wherein said cylindrical bases fit said complementary recesses in a press fit.

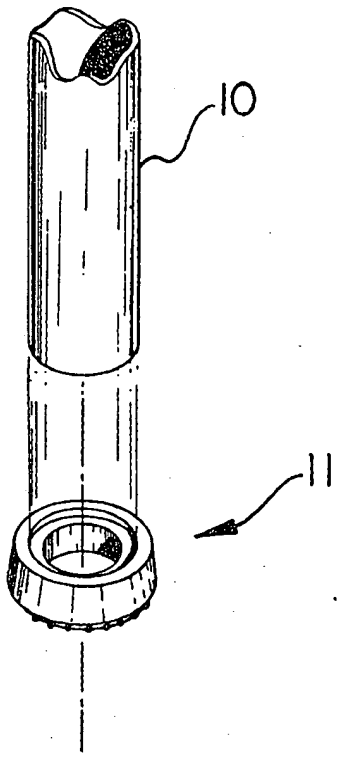

FIGURE 1

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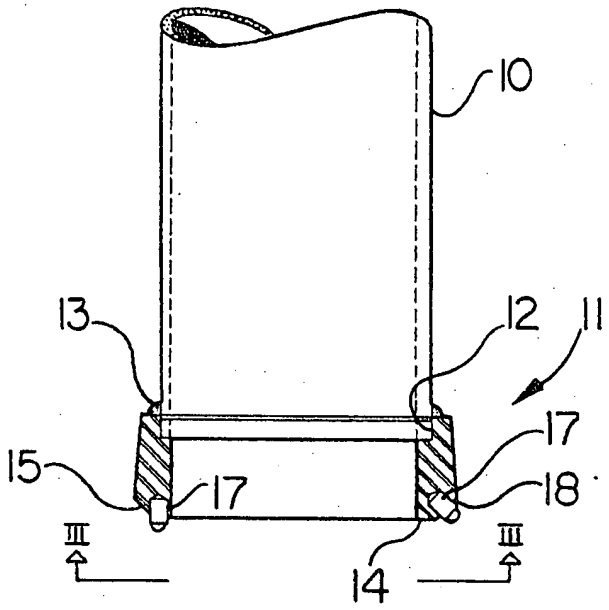

FIGURE 2

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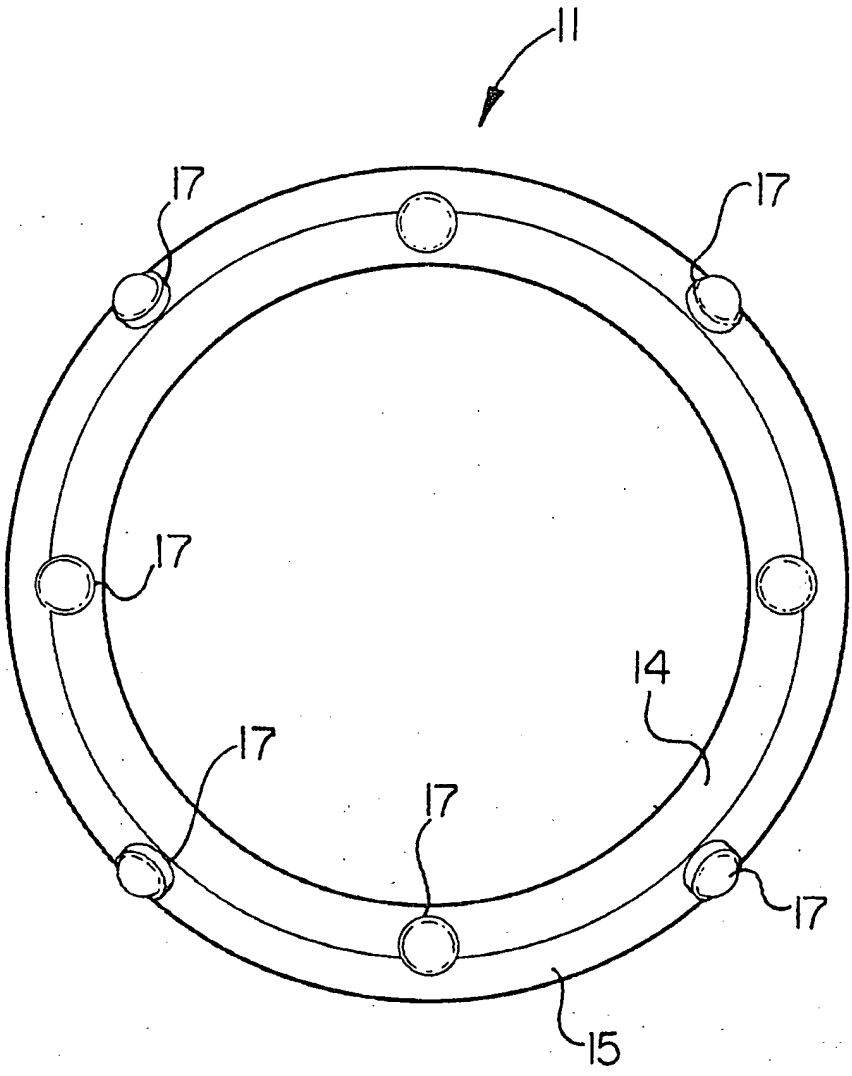

FIGURE 3

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